

Appl. No : **09/971,955**
Filed : **October 4, 2001**

REMARKS

With this Amendment, Claims 29-36, 54-66 and 72-77 are pending in the present application, and Claims 29-31, 54 and 72 are amended. Claims 1-28, 37-53 and 67-71 have been cancelled without prejudice. Applicants reserve the right to pursue the subject matter of the cancelled claims in subsequent continuing applications.

Related Applications

Applicants would like to call to the Examiner's attention the following co-owned and co-pending applications which are related to the present application:

<u>Application #</u>	<u>Art Unit</u>	<u>Examiner</u>
10/614,489	2818	Vu, David
10/614,418	2831	Ha, Nguyen T.
10/615,524	2812	(not yet assigned)

Anticipation under 35 U.S.C. § 102

A number of claims were rejected under 35 U.S.C. § 102(b) as being anticipated by Summerfelt et al (US 5,781,404). However, it is unclear from the Office Action exactly which claims were intended to be rejected under § 102(b), since the Office Action lists Claims 16-17, 29-33, 67-69 and 72-73 as being rejected over Summerfelt, but Claims 16 and 17 are not currently pending in this application. Additionally, Claims 75 and 76 are also discussed in this rejection although they are omitted from the initial list. Furthermore, Applicants submit that the Examiner's assertions as to what is taught by "Fujii et al." are not relevant to the anticipation rejection over Summerfelt. For the purposes of the following response, Applicants will treat Claims 29-31, 72, 73, 75 and 76 as being rejected under 35 U.S.C. § 102(b) over Summerfelt et al, since those are the only claims discussed in the Office Action with respect to Summerfelt et al. in the context of an anticipation rejection.

The Examiner asserts that Summerfelt teaches a thin film structure substantially as claimed. The Examiner asserted that the nucleation layer of Summerfelt is formed of Mn or Nb, and therefore inherently meets the limitations of the rejected claims. Applicants traverse the rejection and respectfully disagree with the Examiner's assertions as to what Summerfelt

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teaches. Applicants also respectfully disagree with the Examiner's interpretation as to what is inherently disclosed in Summerfelt et al.

Claims 29-36 are Patentable

Applicants respectfully submit that Summerfelt et al does not teach or suggest the formation of a donor or acceptor dopant layer as a nucleation layer. Instead, Summerfelt et al teaches the formation of embodiments of an oxide "buffer layer" which can itself be doped with either donor or acceptor dopants. Nonetheless, Applicants submit that these teachings do not fairly suggest the limitations of Applicants' Claim 29, nor are the limitations of Claim 29 inherent in the teachings of Summerfelt et al.

Summerfelt et al. teaches a method of reducing the leakage current of a capacitor by providing additional layers of dielectric material between first and second electrodes. To accomplish this, Summerfelt teaches placing dielectric "buffer layers" of materials (such as strontium titanate) having moderate dielectric constants above and below a BST layer. Summerfelt teaches that the buffer layer materials have substantially lower leakage-current densities than a BST layer.

Summerfelt teaches an alternative embodiment in which a layer of BST (34) is surrounded by a thin-film of strontium titanate (38). The Examiner asserted that Summerfelt's TABLE 2 teaches that the surrounding layer (38) can be formed of Nb or Mn instead of ST. However, Applicants respectfully submit that Summerfelt does not, in fact, teach that the surrounding layer is "formed of" either Mn or Nb alone. Applicants submit that the right-hand column of TABLE 2 of Summerfelt states that "other alternate examples" of a "surrounding dielectric buffer layer" material include "relatively low leakage-current-density acceptor... and/or donor... doped perovskite, ferroelectric, or high-dielectric constant oxides (e.g. (Sr, Ca, Mg)(Ti, Zr, Hf)O₃)"

Mn is listed in TABLE 2 as one of 13 possible elements for use as an acceptor dopant in an oxide layer. Similarly, Nb is listed as one of 18 alternative elements for use as a donor dopant in the oxide layer. Thus, while Summerfelt teaches that the buffer layer can include Mn or Nb as elements in a layer of an oxide compound, there is no suggestion in Summerfelt et al to provide a thin film structure with a nucleation layer consisting essentially of a donor or acceptor dopant material.

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By contrast, Applicants' Claim 29 as amended recites, *inter alia*, "wherein said nucleation layer consists essentially of a donor or acceptor dopant material." Applicants respectfully submit that the fact that Summerfelt lists Mn and Nb in a laundry list of possible elements to be combined into an oxide compound for a "buffer layer" is not suggestive of the limitations recited in Applicants' Claim 29 as amended. Therefore, Applicants respectfully submit that Claim 29 is not anticipated by Summerfelt et al, and Applicants respectfully request that the rejection be withdrawn.

Additionally, with regard to dependent Claims 30 and 31, Applicants respectfully submit that Summerfelt does not teach or suggest the formation of a nucleation layer consisting essentially of Nb, or Mn as suggested by the Examiner, nor does Summerfelt teach or suggest the formation of a nucleation layer consisting essentially of a metal dopant. As discussed above, Summerfelt merely teaches the formation of an oxide "buffer layer" that could *include* Nb or Mn in an oxide compound with any number of other elements. For at least these reasons, Applicants respectfully request that the rejections of Claims 29-31 be withdrawn.

Claims 29-33, 35 and 36 were also rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii et al. in view of Summerfelt et al. However, as discussed above, Summerfelt lacks the teaching of "a nucleation layer for improving the uniformity of a crystal orientation of a BST film formed thereon, wherein said nucleation layer consists essentially of a donor or acceptor dopant material" as recited in Claim 29. Applicants respectfully submit that Fujii et al does not provide the limitations of Claim 29 that are missing from Summerfelt et al as described above, and therefore a *prima facie* case of obviousness has not been established. Thus, Applicants respectfully request that the rejections of Claims 29-33, 35 and 36 under 35 U.S.C. § 103(a) be withdrawn.

Claim 34 was rejected as being obvious over Fujii et al. in view of Summerfelt et al. and further in view of Ueda et al. As discussed above, the combination of Fujii et al. and Summerfelt et al. fails to teach all of the limitations of the rejected claims. Thus, Applicants submit that the rejection of Claim 34 is deficient since Ueda does not provide the missing limitations. Thus, Applicants respectfully request that the rejection of Claim 34 be withdrawn as well.

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Claims 54-66 Are Not Rendered Obvious

Claims 54-66 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii et al. in view of Summerfelt et al. The Examiner suggests that a person having ordinary skill in the art would have found it obvious to incorporate the structure of a strontium titanate layer between a BST layer and a Pt layer (as taught by Summerfelt et al) into the device shown in Fig. 4 of Fujii et al. Applicants traverse the rejection, and respectfully disagree with the Examiner's characterization of the cited references.

The Examiner asserted that it would have been obvious to a person having ordinary skill in the art to provide the suggested combination in order to reduce the leakage current. While this appears to be an accurate characterization of the recited advantages of Summerfelt's structure, Applicants respectfully submit that this would still not have led a person having ordinary skill in the art to *combine* the teachings of Summerfelt with those of Fujii et al., since there is no evidence that the suggested combination would actually produce the beneficial result suggested by the Examiner as the motivation for making the combination.

Applicants respectfully submit that the Examiner's assertion that the claim limitations are inherently met by the structure resulting from the suggested combination is based on the erroneous assumption that Summerfelt et al teaches a thin film structure comprising a dopant layer. Since, as has been shown above, Summerfelt et al. does not include such a teaching, Applicants respectfully submit that the structure resulting from the (improper) combination of Summerfelt et al. and Fujii et al. would not provide all of the limitations of Claim 54.

Fujii et al. (US Patent No. 5,406,445) teaches thin film capacitors having a spinel oxide thin layer or a NaCl oxide thin layer oriented to a (100) face, and a perovskite dielectric thin layer oriented to the (100) face formed between first and second metal electrodes. Fujii teaches embodiments in which a spinel oxide or a NaCl oxide layer is formed above the bottom electrode and embodiments in which a spinel oxide or a NaCl oxide layer is formed below the bottom electrode in order to improve a crystal orientation of the perovskite dielectric thin layer. As discussed in Fujii at column 4, lines 9-27, the invention described therein is intended to improve the electric characteristics of a thin film capacitor by improving the crystallinity of the dielectric layer.

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Summerfelt et al. teaches a method of reducing the leakage current of a capacitor by providing additional layers of dielectric material between first and second electrodes. Summerfelt teaches placing dielectric buffer layers of various oxide materials (such as Strontium Titanate) above and below a BST layer. As discussed above, Applicants submit that Summerfelt does not teach or suggest the formation of a dopant layer of Mn or Nb as suggested by the Examiner.

The Examiner suggests that a person having ordinary skill in the art would be motivated to modify the structure of Summerfelt et al by adding the structure of Fujii et al's Figure 4 in order to reduce the leakage current. However, as the Examiner pointed out, Summerfelt et al. teaches (at Col. 3, lines 15-25) that the structure described therein provides a reduced leakage current by itself. Similarly, the structure of Fujii et al. is described as improving the electrical characteristics of the structure described therein. Thus, a person having ordinary skill in the art desiring to reduce the leakage current of a thin film capacitor would simply follow the teachings of either Summerfelt et al. or Fujii et al., since there remains no suggestion to actually combine the two structure into one.

Additionally, there is no teaching or suggestion in the prior art of record that would lead an ordinarily skilled artisan to believe that providing the suggested combination could be reasonably expected to produce the result suggested by the Examiner. Applicants submit that the art of the claimed invention is sufficiently unpredictable that it is unclear exactly what would result from the suggested combination. Applicants respectfully submit that without a reasonable expectation of success, a person having ordinary skill in the art would not have found it obvious at the time the invention was made to make the combination suggested by the Examiner.

Moreover, Applicants respectfully submit that even if the suggested combination of Fujii and Summerfelt were made (albeit improperly), the claimed invention would not result. As discussed above, Summerfelt et al teaches providing a doped oxide layer, such as a layer of strontium titanate (SrTiO₃), however Summerfelt et al. does not teach providing a nucleation layer consisting essentially of a dopant material. Thus, a combination of the structure of Summerfelt with that of Fujii's Figure 4 would result in a structure including an oxide buffer layer between the bottom electrode and the BST layer (which is a teaching that

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is already present in Fujii et al., so it is unclear why one would look to Summerfelt for such a teaching). Applicants respectfully submit that this structure does not fairly suggest the limitations of Applicants' Claim 54. Thus, Applicants respectfully request that the rejections of Claim 54 be withdrawn. Additionally, dependent Claims 55-66 recite the combination of limitations of Claim 54 as well as additional unique combinations of limitations also not taught or suggested by the prior art of record. Thus, Applicants respectfully request that the rejections of Claims 55-66 be withdrawn as well.

Claims 67-71

Claims 67-71 were rejected under 35 U.S.C. § 103(b) as being unpatentable over Fujii et al. in view of Summerfelt et al. and further in view of Ueda et al. (6,238,966). The Examiner asserts that the combination of Fujii et al. with Summerfelt et al. does not teach a BST film comprising between about 50 and about 53.5 atomic % titanium. However, the Examiner asserted that Ueda teaches a capacitor structure comprising between about 50 and 60 atomic % Ti. Applicants respectfully disagree with the properness of the rejection, however, Claims 67-71 have been cancelled without prejudice in order to advance prosecution. Applicants reserve the right to pursue the subject matter of the cancelled claims in subsequent continuing applications.

Claims 72-77 Are Patentable

Claims 72, 73, 75 and 76 were rejected under 35 U.S.C. § 102(b) as being anticipated by Summerfelt et al., and Claims 74 and 77 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii et al. in view of Summerfelt et al.

As discussed above, Applicants submit that Summerfelt et al. does not describe the formation of a nucleation layer consisting essentially of either Mn or Nb. Thus, for at least this reason, Applicants respectfully request that the rejection of Claim 72 be withdrawn.

Applicants respectfully submit that dependent Claims 73-76 are also patentable for at least the same reasons. With regard to Claim 74, the Examiner asserted "It is noted that the ST layer is considered a second nucleation layer which contains Ti." However, Applicants note that Claim 74 recites, "wherein the nucleation layer *is* Ti" and not merely that the nucleation "contains" Ti. Thus, the fact that Summerfelt teaches a layer made of a compound which includes Ti in combination with other elements (i.e. SrTiO₃), does not fairly suggest a

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nucleation layer which consists essentially of Ti. For these reasons as well, Applicants respectfully request that the rejections of Claims 73-76 be withdrawn.

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CONCLUSION

Applicants respectfully traverse each of the Examiner's rejections and each of the Examiner's assertions regarding what the prior art shows or teaches. Although amendments have been made, no acquiescence or estoppel is or should be implied thereby. Rather, the amendments are made only to expedite prosecution of the present application, and without prejudice to presentation or assertion, in the future, of claims on the subject matter affected thereby. Any arguments in support of patentability and based on a portion of a claim should not be taken as founding patentability solely on the portion in question; rather, it is the combination of all of the features or acts recited in a claim which distinguishes it over the prior art. Additionally, any argument made in support of the patentability of a single claim is intended to refer only to the claim which is addressed in the argument, and should not be read as influencing the interpretation of any other claims or claim limitations.

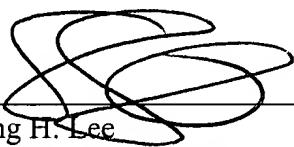
The undersigned has made a good faith effort to respond to all of the rejections and objections in the present application and to place the claims into condition for allowance. Nevertheless, if any issues remain which can be resolved by telephone, the Examiner is respectfully requested to call Applicants' representative at the number indicated below in order to resolve such issues promptly.

Respectfully submitted,

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